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HAMBURG. Equatoreal. (MM. C. & G. Rümker.)

	Hamburg M.T.	R.A.	Dec.	
1849.	h m s	° ′ ″	° ′ ″	
April 20	8 52 9·8	166 8 36·7	− 9 49 0·5	C. R.
26	11 48 59·1	170 30 43·1	59 45 28·9	G. R.
28	11 38 36·5	171 13 42·9	60 56 49·1	—
June 11	12 21 5·4	177 38 35·4	66 58 39·4	—
13	12 38 44·9	178 46 27·7	67 35 32·8	—
14	12 35 57·5	179 21 0·9	67 53 8·5	—
15	12 27 21·3	179 56 3·2	68 9 30·0	—
17	11 35 2·4	181 8 46·2	+68 40 56·0	—

HAVERHILL. (W. W. Boreham.)

	Greenwich M.T.	R.A.	N.P.D.	Star of Comp.
1849.	h m s	h m s	° ′ ″	
May 3	11 7 47	11 2 16·95	59 23 9·9	H.C. 21331
7	10 28 53	3 45·10	51 7 59·5	— 21364
13	9 47 41	7 34·11	41 58 58·7	Arg. Z. 178 : 73
15	11 14 59	9 20·66	39 31 51	B.A.C. 3846
22	11 2 16	16 44·68	33 1 45	Arg. Z. 100 : 22
23	11 0 42	17 59·54	32 16 49·4	Arg. Z. 199 : 19
27	10 46 44	11 23 17·07	29 38 0·2	Arg. Z. 184 : 37

"The first two observations are corrected for refraction and parallax; in the others these corrections are neglected.

"The absence of any stellar nucleus in this comet renders it difficult to observe."

SCHWEITZER'S COMET.

HAMBURG. Equatoreal. (M. Rümker.)

	Hamburg M.T.	R.A.	Dec.
1849.	h m s	° ′ ″	° ′ ″
May 3	9 46 9·2	145 7 42·5	−11 47 18·6

On the Orbits of Double Stars. By M. Yvon Villarceau.

(*Third Notice.*)

ξ Ursæ Majoris.

"M. Savory, who first attempted the problem of determining the elliptic motion of double stars, applied, as is known, his formulæ to the binary system *ξ Ursæ Majoris.*

" M. Savory has only given his result as an example of the computation, pointing out the probability of a great difference between his elements and the true elements. The observations at his disposal only extended to 1827, and it is remarkable that his determinations do not differ more widely from those which are deduced

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from the observations of 20 additional years. M. Savory's greatest difficulties must have occurred in passing from the observed positions to those which he has substituted, which are the base of his calculations. It is to be regretted that the learned Academician has not thought it necessary to enter into the details.

"Mr. Mädler has since occupied himself with the same star, using observations which extend to 1841. The elements which he has deduced do not differ considerably from those which I have the honour to present.

"The system of ξ *Ursæ Majoris* consists of two stars. These are, according to M. Struve, of the 4th and 5th mag. respectively. M.M. Herschel and South estimate them of the 6th and 6¼ mag.

"The earliest observation of ξ *Ursæ Majoris* was made by Sir W. Herschel in 1781·97; he reobserved it again in 1802 and 1804. The last two observations are only equivalent to one distinct position in regard to the determination of elements. From 1819 to the present time numerous observations have been made by different astronomers, and particularly by M. M. Struve and Sir John Herschel. The series is almost continuous.

"I have obtained a first approximation to the elements by the new method which I presented to the Academy at its sitting on March 26. For this purpose and to simplify the computations, I united in six groups, as well for the angles of position as for the distances, 20 observations of position and 17 of distance, extending from 1819 to 1847. A preliminary graphical construction had shewn me the possibility of grouping the observations without notable error. I have found, as I had previously expected, that these observations alone, though embracing a period of 28 years and containing an angular displacement of 152°, were not by themselves sufficient even for an approximate value of the elements. For example, one could satisfy them within the limit of moderate errors with a periodic time of 166 years, and even longer, or with one of about 61·5 years. Besides this, the problem then becomes doubly indeterminate, as two of the constants on which the elements depend may receive independent variations. The ancient observations are necessary, and sufficient to destroy the double indetermination: comparing that of 1781·97 with the modern observations, we obtain at once 62 years as an approximate value of the periodic time. From this the mean motion is deduced, whence results an equation of condition between the two indeterminate constants, from which one of these may readily be expressed in a function of the other. In this manner only one arbitrary quantity is left, the value of which is fixed by the condition of satisfying a single angle of position, the result of the two observations of 1802 and 1804. The degree of approximation at which I have thus arrived is tolerably satisfactory, notwithstanding the employment of somewhat indifferent observations from 1819 to 1823, the effect of which is to alter the calculated angles of position for that interval.*

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* Many of these observations were made with meridian instruments.

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"If my only object had been that of obtaining an orbit of ξ *Ursæ Majoris*, this first determination would have been sufficient. But it is important for the discussion of observations, and the perfecting of micrometrical measurements to which this discussion may lead, to obtain the highest possible degree of precision. I have therefore set myself to correct my first elements, by employing all the known angles of position (two alone excepted) and all the measures of distance made by M.M. Struve since 1825. I have also employed one observation of 1828, which M. Otto Struve has had the kindness to send me, and which I did not receive till after the first portion of my work was completed. By means of the errors resulting from a comparison of observations with the approximate elements, I have formed eight groups for the angles of position and five for the distances. From these I have deduced *normal* positions, which I have substituted for the observations. The elements corrected by using these *normal* positions, and compared with the observations, have given for each of the above groups errors, the means of which coincide very nearly with the errors resulting from a comparison with the *normal* places. This proves that I should not sensibly have obtained greater precision by employing all the observations than by employing the *normal* positions.

"I present here the approximate and corrected elements, and also a comparison of each with the observations: —

Elements of the relative Orbit of ξ *Ursæ Majoris*.

1826·0 R.A. = 11$^{\mathrm{h}}$ 8$^{\mathrm{m}}$·8 N.P.D. 57° 30′, 4 and 5 mag.

	First Approximation.	Second Approximation.
True Perihelion Passage....	1817$^{\mathrm{y}}$·436 & 1879$^{\mathrm{y}}$·436	1816$^{\mathrm{y}}$·859 & 1878$^{\mathrm{y}}$·435
Mean Annual Motion......	5°·8064	5°·8464
	° ′	° ′
Angle (sin = excentricity)...	26 2·0	25 33·7
Long. Asc. Node, reckoned from the apparent North in 1834·4 towards the East	276 5·5	275 50·0
Dist. of Per. to Asc. Node ..	311 5·3	308 57·2
Inclination	±128 22·6	±127 11·4
Semi-axis major (observations of MM. Struve)....	2″·4082	2″·4389

Hence I deduce,

	years.	years.
Periodic Time	62·0	61·576
Excentricity..............	0·43891	0·43148

For the apparent orbit I find,

	Date.		Position.	Dist,
	y	y	° ′	″
Greatest apparent Aphelion..	1795·111 &	1856·687	112 46·4	3·0538
Least — —	1824·461	1886·037	247 15·2	1·7187
Least apparent Perihelion...	1814·760	1876·336	356 12·5	0·8891
Greatest — —	1828·881	1890·457	218 25·8	1·6924

"The angles of position in this table are reckoned from the same origin as the ascending node.

Comparison of the Ele

	Observations.				
Date.	Angles of Position.	Distance.	Magnifying Power.	Number of Days.	Observer.
	° ′	″			
1781·97	143 47			1	W. Herschel.
1802·09	97 31			1	—
1804·08	92 38			1	—
1819·10	284 33			2	W. Struve.
1820·13	276 21			3	—
1821·78	264 42			3	—
1823·29	258 27			4	Herschel & S
1825·22	242 32				South.
1826·20	238 45	1·747	600	3	W. Struve.
1826·20	238 17				South.
1827·27	228 16	1·715	570	4	W. Struve.
1828·37	224 1				J. Herschel.
1829·02	219 0				—
1829·35	213 35	1·671	583	7	W. Struve.
1830·58	206 18				J. Herschel.
1831·08	201 32				Bessel.
1831·25	201 7				J. Herschel.
1831·34	201 55				Dawes.
1831·44	203 49	1·706	600	5	W. Struve.
1832·16	198 10				J. Herschel.
1832·27	196 43				Dawes.
1832·41	195 56	1·750	600	5	W. Struve.
1833·14	189 58				J. Herschel.
1833·23	189 50				Dawes.
1833·84	188 25	1·762	1000	5	W. Struve.
1835·41	180 11	1·764	920	5	—
1836·44	171 12	1·972	800	4	—
1837·47	165 19	1·927		3	Struve, *Addita*
1837·53	167 23				Encke.
1838·43	160 23	2·260		9	Struve, *Addita*
1839·47	157 58				Galle.
1840·25	152 14				Kaiser.
1840·40	155 24	2·286	858	7	W. & O. Struve
1841·29	150 12				Mädler.
1841·402	152 8	2·282	858	6	O. Struve.
1842·40	148 47	2·410	858	4	—
1844·788	140 52	2·526	858	5	—
1846·365	138 49	2·620	858	4	—
1847·407	131 50	2·700	858	3	—
1848·406	128 43	2·752	858	5	—

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ith the Observations.

First Approximation.			Second Approximation.		
Angles of Position.		Distance.	Angles of Position.		Distance.
Calculated—Observed.		Cal^d—Obs^d.	Calculated—Observed.		Cal^d—Obs^d.
Diedral.	In Arc.		Diedral.	In Arc.	
° ′	″	″	° ′	″	″
−0 22	−0·016		+0 16	+0·011	
+0 42	+0·034		+0 11	+0·009	
0 32	0·024		−0 8	−0·006	
5 34	0·129		+1 0	+0·025	
3 54	0·099		0 26	0·012	
+2 21	+0·065		+0 4	+0·002	
−2 8	−0·061		−3 40	−0·110	
+0 40	+0·019		0 10	0·005	
−2 10	−0·063	−0·080	2 43	0·081	−0·038
−1 42	−0·049		−2 15	−0·067	
+1 4	+0·031	−0·051	+0 47	+0·023	−0·015
−2 8	−0·062		−2 13	−0·065	
−1 31	−0·044		−1 30	−0·044	
+1 40	+0·049	0·000	+1 44	+0·051	+0·022
0 45	0·022		0 55	0·027	
2 15	0·067		2 26	0·073	
1 34	0·046		1 45	0·052	
+0 11	+0·006		+0 22	+0·011	
−2 22	−0·071	+0·002	−2 10	−0·065	+0·013
1 18	0·039		1 6	0·033	
0 32	0·016		0 20	0·010	
−0 37	−0·019	−0·011	−0 25	−0·013	−0·006
+0 53	+0·027		+1 3	+0·032	
+0 28	+0·014		+0 39	+0·020	
−1 43	−0·054	+0·037	−1 34	−0·049	+0·036
−2 12	−0·073	+0·119	−2 10	−0·071	+0·112
+1 31	+0·051	−0·025	+1 26	+0·048	−0·034
2 28	0·087	+0·089	+2 18	+0·080	+0·078
0 7	0·004		−0 3	−0·002	
3 6	0·113	−0·176	+2 50	+0·102	−0·188
1 11	0·045		0 50	0·031	
3 51	0·149		+3 26	+0·132	
0 7	0·005	−0·055	−0 18	−0·012	−0·069
+2 4	+0·083		+1 34	+0·062	
−0 16	−0·011	+0·025	−0 47	−0·031	+0·012
−0 20	−0·014	−0·027	0 55	0·038	−0·040
+0 14	+0·010	+0·033	0 29	0·021	+0·022
−2 3	−0·096	0·047	−2 51	−0·132	0·038
+2 15	+0·107	0·034	+1 25	+0·067	0·025
+2 55	+0·142	+0·042	+2 2	+0·099	+0·034

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"These two sets of elements do not present any remarkable difference; nevertheless, the correction of the first has sensibly diminished the differences between the calculated and observed places. In the second approximation the greatest errors in the distances belong to 1835 and 1838; the last is almost 0″·2. It is evident, on comparing the neighbouring observations, that the greatest share in these errors belongs to the observations themselves. The other distances are well represented. As to the angles of position, there are only four which vary from 0″·10 to 0″·13, and here the fault may be imputed chiefly to the observations. Taking a mean of the variations which exist with the corrected elements, I find 0″·046 both for angles of position and for distances. This result shews how advantageously the distances of M. M. Struve may be employed.*

"M. Struve estimates the probable error of a mean of three measures, when the distances are nearly those of the preceding table, to be 0″·05 for distances, and 0″·03 for angles of position. The mean error assigned above is rather less than M. Struve's for distances, and half as large again for angles of position. The agreement in the angles of position for this star is not quite so satisfactory as that which I found in my researches on η *Coronæ*. The differences in the second approximation shew permanences of sign which cannot be made to disappear by correcting the elliptic elements. As to the cause, it cannot be searched for here, in perturbing actions or in aberrations, since the observations are barely sufficient to determine the constants of elliptic motion."†

Note upon the Mass of the Planet Neptune, as deduced from Observations of his Satellite. By Mr. Hind.

"The satellite of *Neptune* has been frequently observed at Starfield by Mr. Lassell; at Cambridge, United States, by Professor Bond; and at Pulkova by M. Otto Struve. There are about forty complete observations of position and distance up to the end of October 1848.

"By supposing the inclination of the orbit of the satellite to the ecliptic = 30° and the place of the node in 300°, and by assuming

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* I have not compared the distances observed by other astronomers, as they are not in sufficient numbers to give the value of the semi-axis major which corresponds to each observer.

† Calculated elliptic elements cannot be made to satisfy a series of distances, unless the distances are absolutely correct; a constant error, such as has been suspected from the varying results of different observers, will spoil the coincidence. It is much to be wished that observers who possess instruments of sufficient power would carefully and repeatedly measure the distances of ξ *Ursæ Majoris*, η *Coronæ*, &c., in order that something definite may be known of the extent and constancy of these personal or instrumental equations. Possibly the true measure might be approximated to, by assuming a correction for each observer, such as would make the elliptic elements, deduced from angles of position, agree best with his observed distances.